Oct. 12, 1971 W. KLEIN ET AL 3,611,766

DETONATION CHAMBER FOR EXPLOSIVE WORKING OF METALS

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FIG. 1

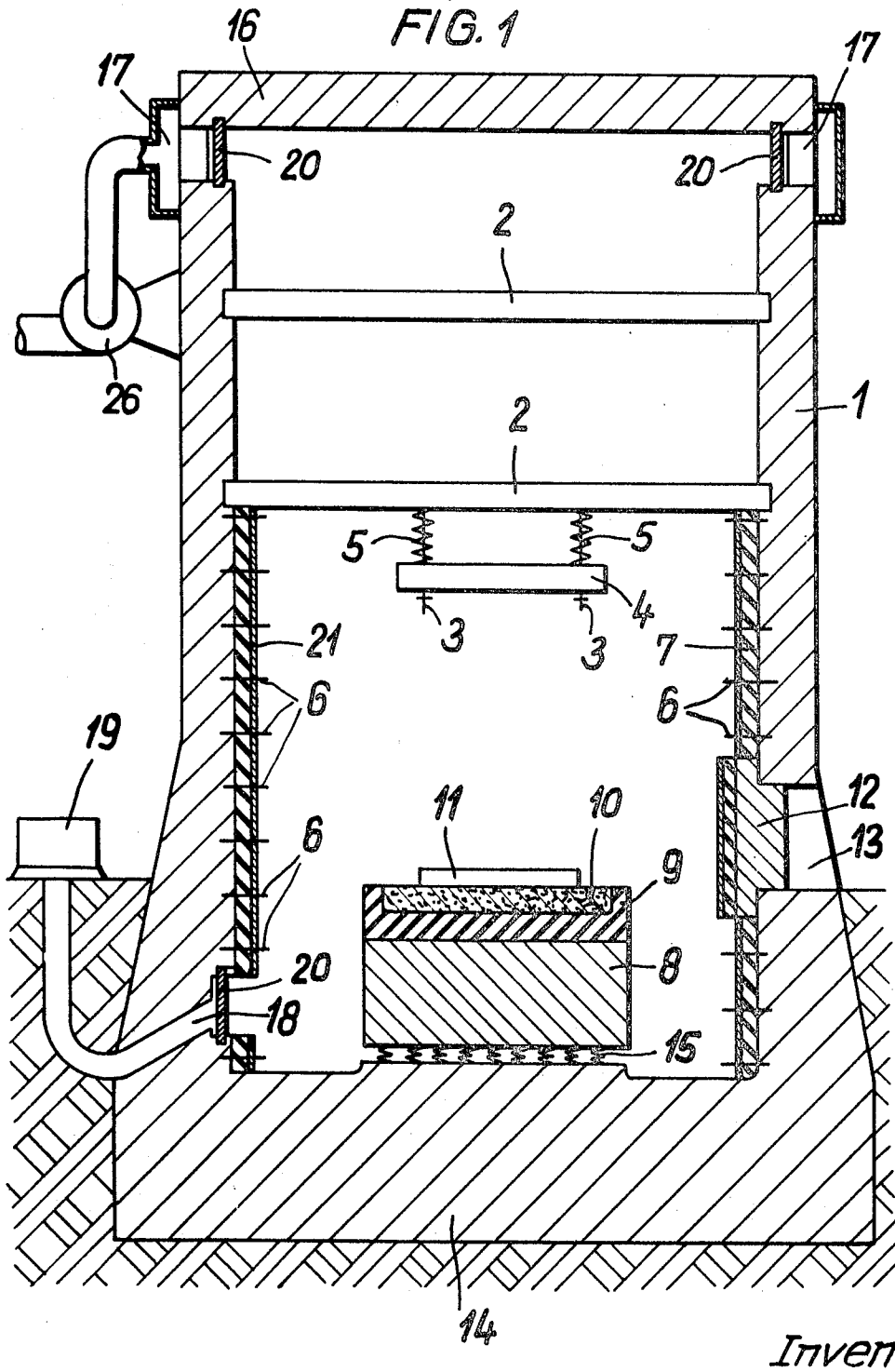

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FIG. 2

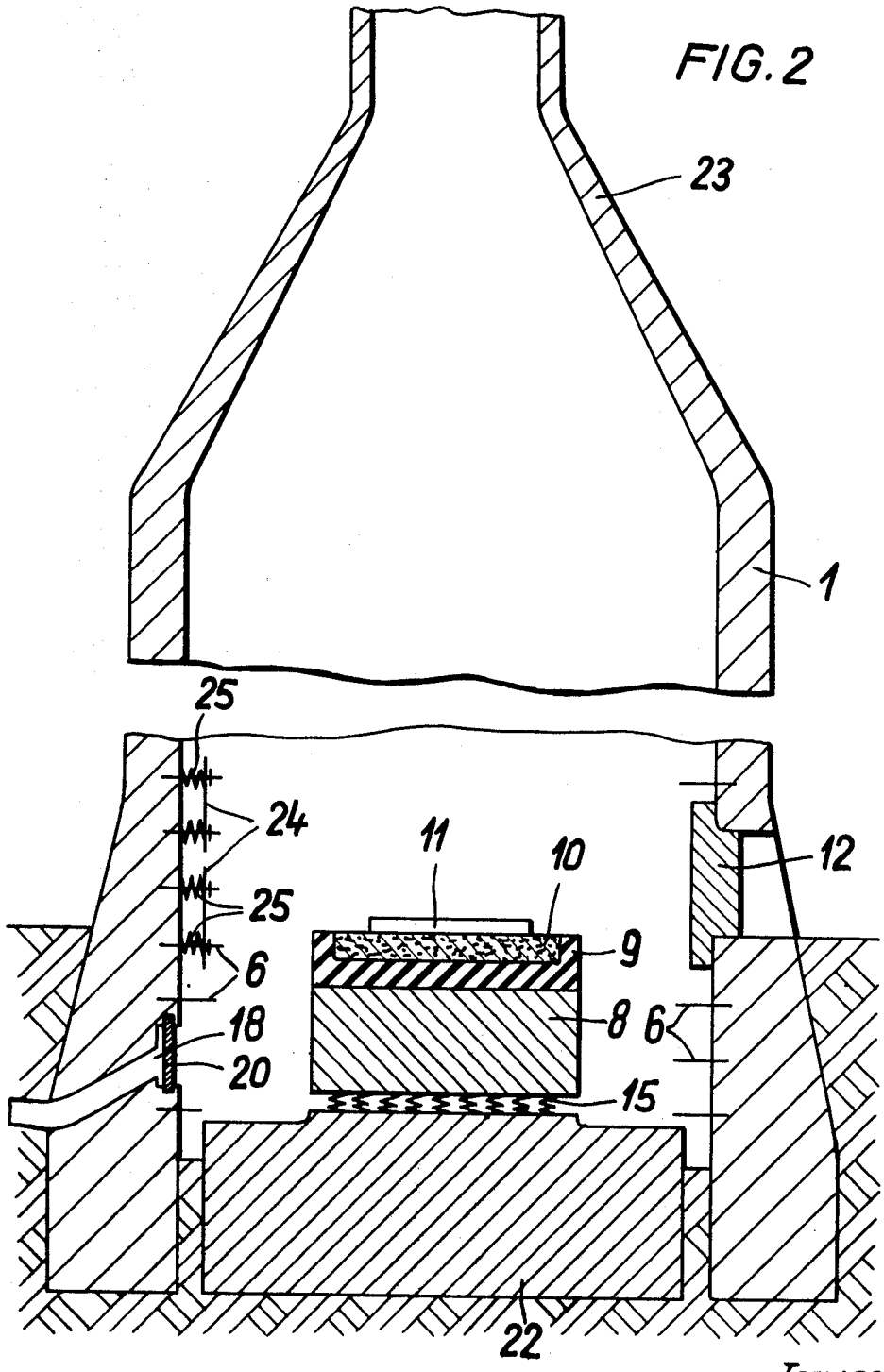

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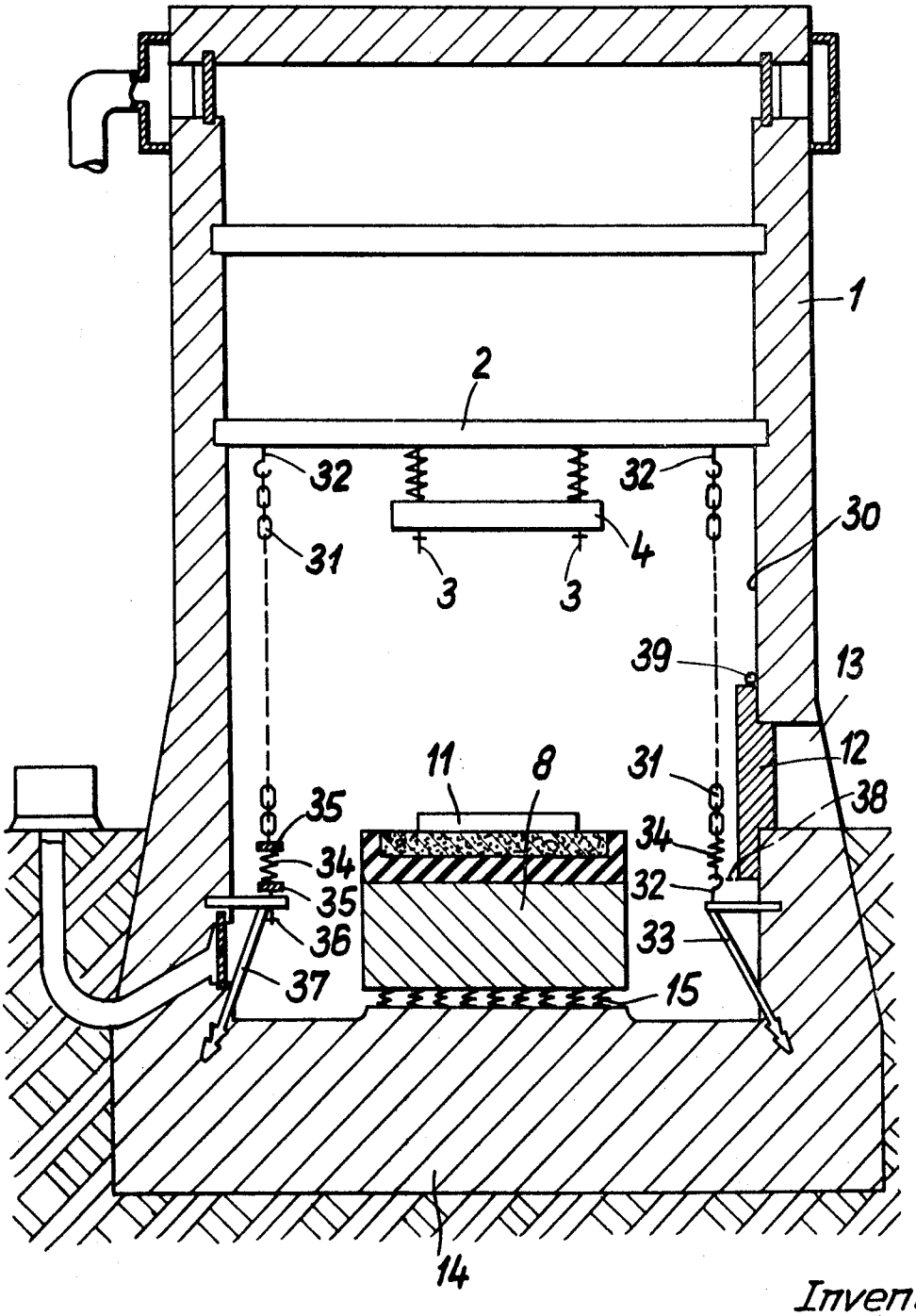
FIG. 3



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DETONATION CHAMBER FOR EXPLOSIVE WORKING OF METALS

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Int. Cl. B21d 26/08
U.S. Cl. 72—56 25 Claims

ABSTRACT OF THE DISCLOSURE

A detonation chamber for explosive working of metals, which includes: a substantially cylindrical hollow body with its longitudinal axis extending substantially vertically, foundation means supporting said hollow body, and cushioned table means arranged in the lower portion of said hollow body for receiving and supporting the means to be explosive worked.

The present invention relates to a detonation chamber for explosive working of metals and, more specifically, concerns a detonation chamber of this type which is supported by a foundation and is composed of a suitable material and primarily comprises a cylindrical hollow body which is so arranged that its axis extends substantially vertically.

Methods for explosive working of metals are known, especially for plating, transforming and hardening of metals, and are being used more and more in view of the advantages inherent thereto and have become firmly accepted in the art of treating materials and in the art of transforming materials. In view of the noise development inherent to this method, such methods can be carried out in a non-guarded manner only on special firing ranges. Firing ranges, however, are available only in a limited number and, as a rule, are located far away from the production plants in which the pertaining preparations and further processing are carried out. The thus inherent high costs of transportation and often necessary renting costs make the above mentioned method uneconomical.

It is, therefore, an object of the present invention to provide a detonation chamber for explosive working of metals which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a detonation chamber as set forth above which will make it possible to carry out the explosive working of metals in a dangerless manner which will not annoy the surrounding areas and which can be carried out in the vicinity of the respective production plant and even in densely populated areas.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 diagrammatically illustrates a vertical section through a detonation chamber according to the present invention.

FIGS. 2 and 3 respectively illustrate vertical sections through modified detonation chambers according to the invention.

For explosion transforming methods, according to which the explosive is ignited in water and in which the water conveys the explosive forces in the form of pressure waves to the work piece to be processed, ordinarily the method is carried out in a simple manner in a water-filled detonation pit. Such pits, however, have the drawback that they are suitable only for a small portion of the explosive working method and that it is not possible to protect the vicinity against ground waves and especially noise to any sufficient extent.

Therefore, especially for the examination of explosives, detonation chambers have become known which in most instances are bell-shaped. In these detonation chambers, as a rule, granular material, especially sand, is whereby a cushioning of the pressure waves caused by the detonation is to be effected. Such detonation chambers, however, are suitable only when relatively small quantities of explosives are employed.

When larger quantities of explosives are employed, a substantially bell-shaped detonation chamber has been suggested which, however, is used only in connection with such explosive working according to which the interior of the bell-shaped chamber is evacuated. A detonation chamber in the form of a ball-shaped container is, however, very costly and expensive when it is to be used for major technical operations. Moreover, it has been found that the bell-shape is not advantageous when carrying out explosive plating and hardening in view of the primarily upwardly directed pressure shock.

In view of the above, according to the present invention, a substantially cylindrical hollow body is suggested as detonation chamber which body is so arranged that its axis extends substantially vertically. A detonation chamber according to the invention is characterized primarily in that its lower portion contains a cushioned working table for receiving the arrangement for explosive working.

According to a particularly advantageous embodiment of the invention, the cushioned working table which advantageously is provided with at least one cushioning, layer for instance of rubber or sand, rests on a separate foundation.

Furthermore, especially for a better sound absorption, it is advantageous to make the cylindrical hollow body of prestressed steel concrete instead of making it of steel. However, under some circumstances, the steel construction may have advantages. For purposes of distributing by turbulence and for at least partially destroying the energy inherent to the explosion smoke, it is advantageous to provide in the upper portion of the hollow body at least one grate-like partition below which there are provided preferably cushioned impact plates connected to said partition.

For the same purpose, the hollow body may have its upper end tapered. It is advantageous, for reducing the load on the walls, to provide inserts or linings in the lower portion of the hollow body.

In this connection it is particularly advantageous to arrange in the lower portion of the hollow body and parallel to its axis chains, wires, or the like of steel or synthetic material which are arranged adjacent to each other and are substantially equally spaced from the inner wall of the hollow body. The effect of such an arrangement is further improved by connecting the chains, wires, or the like, at least once, preferably at their ends, with elastic elements, as for instance tension springs.

The inserted chains, wires, or the like surprisingly reduce the load acting upon the walls of the cylindrical hollow body over heretofore known inserts to an unexpected extent. A fast renewed readiness of operation after effected firing is obtained by gas withdrawing passages which are arranged at the upper end of the hollow body and communicate with a blower. The effect of these passages can be further improved by providing passages in the lower area of the hollow body and connecting said last mentioned passages with a blower for supplying fresh air. In this way, a fast working sequence and a correspondingly high output can be obtained.

Referring now to the drawings in detail, the detonation chamber shown in the various figures comprises a cylindrical hollow body 1 having a substantially vertical axis

and consisting of prestressed steel concrete. Provided in the upper portion of the hollow body **1** are grate-like partitions **2** which consist preferably of strong steel girders or other profiled steel members. To the lower partition **2** and, more specifically, at the lower side thereof, there are connected anchors **3** which support an impact plate **4** which is movable in vertical direction. Between the impact plate **4** and the partition **2** there are provided springs **5**. The lower portion of the inner wall of the hollow body **1** is equipped with further anchors **6** for connecting linings **7** or other inserts which serve primarily for absorbing energy. In the lower portion of the hollow body **1** there is provided a cushioned working table **8** the upper side of which is covered by a rubber layer **9**. The rubber layer **9** has its upper side provided with a recess for receiving a layer **10** of sand on which the work piece **11** or the like is placed which is to be explosion worked. An armored door **12** which can be opened only toward the inside will when under load from the inside rest on the inner wall of the cylindrical hollow body **1**. This armored door **12** is adapted to close an opening **13** in the hollow body **1** through which opening the work piece **11** or the like to be explosion worked is introduced by means of a non-illustrated manipulator. The lower edge of the opening **13** and the upper edge of the working table **8** are for this reason arranged at substantially the same level.

According to the embodiment shown in FIG. 1, the bottom of the hollow body **1** simultaneously forms the foundation **14** of the detonation chamber on which the working table **8** rests through the intervention of spring elements **15**. The upper end of the hollow body **1** is closed by a cover plate **16** which is anchored to the side wall portion of the hollow body. The cover plate **16** may, if desired, be arched. Directly below the cover plate **16** there are provided passages **17** which are located in the hollow body **1** and communicate with a blower **26** for withdrawing gases. Furthermore, in the lower area of the hollow body **1** there are provided passages **18** which either communicate with the outer atmosphere or which represent suction openings or which communicate with the blower **19** for supplying fresh air. In similar instances it is advantageous to connect only a part of the passages **18** with a fresh air supplying blower **19**. The passages **17** and **18** at their connection with the hollow body **1** are, primarily for the protection of the blower, provided with valves **20** which are adapted to be controlled from the outside. The lining **7** of the embodiment of FIG. 1 consists of rubber and is covered by a protective layer of asbestos **21**.

FIG. 2 illustrates a detonation chamber according to the invention in which the cushioned work table **8** rests on a separate foundation **22**. In this way, this detonation chamber is with substantially the same dimensions as employed for the embodiment of FIG. 1 suitable for the employment of still larger quantities of explosives because stresses occurring in the foundation during the detonation are to a greater extent eliminated. The upper end **23** of the hollow body **1** tapers in upward direction. With this design, an absorption of the energy is obtained in a simple manner by choking, while partitions may be saved. In the upwardly tapered portion **23** there may be provided a shock absorber (not shown).

A filter for filtering the explosive gases may likewise be provided in said tapering portion. The passages **17** shown in FIG. 1 for withdrawing explosive gases may be omitted with the embodiment of FIG. 2. Instead of providing a lining **7** of rubber, according to the embodiment of FIG. 2, cushioned impact plates are arranged on the anchors **6** which plates **24** are movable radially outwardly and during their movement are adapted to convey the energy absorbed from the detonation gases to springs **25** which partially destroy said energy so that only a minor portion of the energy will be conveyed to the wall of the hollow body **1**. The impact plates **24** and the impact plates **4** may additionally be provided with a layer of energy absorbing material. If desired, instruments may be installed which permit measurements within the hollow body **1**. Such instruments may be arranged at any desired place and can easily be connected to the respective anchors **6**.

According to the embodiment of FIG. 3, chains **31** are arranged in the lower portion of the hollow body **1** parallel to the axis of said hollow body. These chains are substantially equally spaced from the inner wall **30** and are provided adjacent to each other while consisting of steel or synthetic material. The chains **31** are connected to hooks **32** which are arranged on the partitions **2** or on brackets **33** connected to the hollow body **1**. As illustrated in the right-hand portion of FIG. 3, a tension spring **34** may in a simple manner be interposed between the lower hook **32** and the chain **31**.

It is advantageous respectively to provide between the chains **31** and the tension springs **34** and also between the tension springs **34** and the brackets **33** a ring **35** as shown in the left-hand portion of FIG. 3. The number of the tension springs **34** may be less than the number of the chains **31**. If one of the tension springs **34** should fail by breaking or by fatigue, the tension of the chains **31** in this area will only slightly be affected. Moreover, in this way a preload in the tension springs **34** and in the chains **31** can be effected with only a few tensioning elements **36** connected to the lower ring **35** which tensioning elements are uniformly distributed over the circumference of the ring **35** and rest on brackets **37**. In this way, the preload of the springs **34** and chains **31** can easily be effected and controlled.

It is a matter of course that the tension springs **34** and/or the rings **35** instead of being arranged at the lower end of the chains **31** may also be arranged at the upper end or any other portion of the chains **31** or may simultaneously be arranged at a plurality of the said areas.

The lower end of the door **12** has arranged thereon hooks **38** which instead of hooks **32** hold the chains **31**. When the door **12** is opened by turning about the pivot axis in the hinge **39**, the chains **31** remain connected to the hooks **32** and are lifted together with the door **12** and are removed from the area of the opening **13**. When the door **12** is closed, the chains **31** and the springs **34** are at the same time tensioned again. When employing rings **35**, the said rings are recessed in the area of the door **12** or are interrupted in said area.

The foundations of the detonation chamber or of the work table **8** are advantageously embedded in a material which is adapted well to absorb ground waves.

As will be evident from the above, the detonation chamber according to the present invention can be produced at low costs and assures a good shielding. The detonation chamber according to the present invention also makes it possible to detonate larger quantities of high explosive materials, for instance, quantities of 80 kg. and more, for the explosive working of metals.

It is, of course, to be understood that the present invention is, by no means, limited to the particular showing in the drawings but also comprises any modifications within the scope of the appended claims.

What we claim is:

1. A closed detonation chamber for explosive working of metals, which includes: a substantially cylindrical hollow body with its longitudinal axis extending substantially vertically, foundation means supporting said hollow body, cushioned table means arranged in the lower portion of said hollow body for receiving and supporting the means to be explosive worked, and intermediate grate-shaped partition means located in the upper collective cross-sectional portion of said substantially cylindrical hollow body.

2. A closed detonation chamber according to claim 1, in which said cushioned table means is supported by said foundation means.

3. A closed detonation chamber according to claim 1, in which said foundation means comprises an annular section supporting said hollow cylindrical body and also includes an inner section surrounded by and in spaced relationship to said annular section and supporting said cushioning table means.

4. A closed detonation chamber according to claim 3, in which said cushioned table means is provided with at least one layer of shock absorbing material thereon.

5. A closed detonation chamber according to claim 4, in which said shock absorbing material is formed by rubber material upon said table means.

6. A closed detonation chamber according to claim 4, in which said shock absorbing material is formed by sand upon said table means.

7. A closed detonation chamber according to claim 4, in which said substantially cylindrical hollow body is made of steel.

8. A closed detonation chamber according to claim 1, in which said substantially cylindrical hollow body is made of prestressed steel concrete.

9. A closed detonation chamber according to claim 1, which includes cover plate means arranged at the upper end of said substantially cylindrical hollow body for closing said upper end.

10. A closed detonation chamber according to claim 1, in which the upper end of said substantially cylindrical hollow body tapers more in upward direction of wave widening.

11. A closed detonation chamber according to claim 1, which includes anchor means arranged in the lower portion of said hollow body and energy consuming insert means supported by said anchor means.

12. A closed detonation chamber according to claim 11, which includes lining means arranged within the area of said anchor means.

13. A closed detonation chamber according to claim 12, in which said lining means has a fire resistant protective cover.

14. A closed detonation chamber according to claim 13, in which said protective cover consists of asbestos.

15. A closed detonation chamber according to claim 13, in which said fire resistant protective cover consists of a fire resistant coat.

16. A closed detonation chamber for explosive working of metals, which includes a substantially cylindrical hollow body with its longitudinal axis extending substantially vertically, foundation means supporting said hollow body, cushioned table means arranged in the lower portion of said hollow body for receiving and supporting the means to be explosive worked, anchor means arranged in the lower portion of said hollow body and energy consuming insert means supported by said anchor means, and impact plate means arranged in the region containing said anchor means and at least partially connected to said substantially cylindrical hollow body.

17. A closed detonation chamber according to claim 16, which includes cushioning means associated with said impact means for cushioning the same.

18. A detonation chamber for explosive working of metals, which includes: a substantially cylindrical hollow body with its longitudinal axis extending substantially vertically, foundation means supporting said hollow body, cushioned table means arranged in the lower portion of said hollow body for receiving and supporting the means to be explosive worked, grate-shaped partition means located in the upper portion of said substantially cylindrical hollow body, and cushioning impact plate means arranged below and connected to said partition means.

19. A closed detonation chamber according to claim 1, which includes suspended means extending substantially parallel to the axis of said substantially hollow cylindrical body and arranged in the lower portion thereof while being substantially equally spaced from the inner wall of said substantially cylindrical hollow body.

20. A closed detonation chamber according to claim 19, in which said suspended means include chain means.

21. A closed detonation chamber according to claim 19, which includes elastic means connected to at least one end of said suspended means.

22. A closed detonation chamber according to claim 21, in which the upper portion of said substantially cylindrical hollow body is provided with passage means adapted to be connected to a suction blower.

23. A closed detonation chamber according to claim 22, in which the lower portion of said substantially cylindrical hollow body is provided with passage means at least some of which is adapted to be connected with a source of fresh air.

24. A closed detonation chamber according to claim 23, which includes control means for controlling communication of at least some of the passage means in the lower portion of said substantially cylindrical hollow body with the interior thereof.

25. A closed detonation chamber according to claim 24, in which said substantially cylindrical hollow body approximately at the area of said table means is provided with an opening, and which includes armored door means for selectively opening and closing said opening.

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